APPENDIX H

PRELIMINARY RISK ASSESSMENT

Technical Memorandum

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To: Old Toxic Training Area, Parcel 188(7), Fort McClellan, Calhoun County, Alabama
Preliminary Risk Assessment File

Date: 9 May 2002

Subject: **PRELIMINARY RISK ASSESSMENT FOR SUBJECT SITE**

This memorandum provides a Preliminary Risk Assessment (PRA) for the Old Toxic Training Area, Parcel 188(7), herein referred to as Parcel 188(7). Parcel 188(7) consists of a small 0.95-acre L-shaped area. The training area proper is reported to be located in a ditch or shallow depression. The area was used in the 1950s and 1960s to train military personnel in the detection and identification of various chemical warfare agents (CWA).

The purpose of the PRA is to support a recommendation for no further action and unrestricted site use proposed by the Site Investigation (SI). The PRA approach is a shortened version of the Streamlined Risk Assessment (SRA) protocol developed as a uniform and economical approach to evaluating hundreds of similar sites at Fort McClellan (FTMC). It is assumed that the reader is familiar with FTMC and the fundamentals of the SRA protocol. The reader is referred to the Installation-Wide Work Plan (IT, 2002) for more detail. All the comparison and computational operations of the PRA are performed within EXCEL® spread sheet tables. The results of each step are described below. The PRA was performed in two iterations – a first iteration and a refined assessment – to more precisely evaluate the potential for noncancer effects, as explained below.

Media of Interest and Data Selection. Media of interest are surface soil, subsurface soil and groundwater. Surface and subsurface soil data were combined to form a medium called total soil for certain receptor scenarios as described below. Data consist of four samples of each medium – each sample taken from a separate location at which a groundwater monitoring well was installed and developed. Surface soil samples were taken from 0 to 1 feet below ground surface (ft bgs), subsurface soil samples were taken from 5 to 9 ft bgs. The depth of screening for the monitoring wells was not available for this evaluation. All samples were analyzed for metals, semivolatile organic compounds (SVOC), volatile organic compounds (VOC) and CWA degradation products. All the analytical data were validated.

Site-Related Chemical Selection. Site-related chemicals are those presumed to be released by the army during operation of FTMC. Site-related chemicals were selected by comparing the maximum detected concentration (MDC) of each chemical with its background screening criterion (BSC), computed as two times the mean of the background data set, consistent with EPA (2002) Region IV guidance. BSCs were taken from SAIC (1998). Chemicals whose MDCs exceed their BSCs were selected as site-related chemicals and were subjected to chemical of

potential concern (COPC) selection (described below) for inclusion in the first iteration of the risk assessment.

The site-related chemicals chosen in this manner are identified in Tables 1 and 2 for surface soil, Tables 3 and 4 for total soil, and Tables 5, 6, and 7 for groundwater. Site-related chemicals in soil include most of the metals, and all of the SVOCs and VOCs. SVOCs identified in soil were limited to a long list of polyaromatic hydrocarbons (PAH). VOCs identified in soil include a long list of alkylated benzenes and a few simpler compounds such as acetone, 2-butanone and 4-methyl-2-pentanone. Chlorinated solvents were not identified in either surface or subsurface soil. Site-related chemicals in groundwater include a few metals and two VOCs, limited to carbon disulfide and carbon tetrachloride. Xylene in soil and methylene chloride in groundwater were included in the data presented in the SI, but these data are not included in the PRA because of blank contamination.

Upper tolerance limits (UTL), the highest metal concentrations reasonably considered to be within background, are also included in Tables 1 through 7 for information, but were not used to select site-related chemicals. The UTL may provide a more refined statistical approach than the BSC for comparing site and background data, but UTLs were not used for this evaluation.

Chemical of Potential Concern Selection. COPCs are site-related chemicals whose MDCs exceed their site-specific screening levels (SSSL), and which may contribute significantly to risk. The SSSLs are receptor-, medium-, and chemical-specific risk-based concentrations that capture all the exposure assumptions and toxicity assessment of a full-blown baseline risk assessment. COPCs were selected for both cancer risk and noncancer effects when the data were sufficient (Tables 1 through 7). COPCs include aluminum, antimony, arsenic, chromium, iron, vanadium and benzo(a)pyrene in soil, and barium and nickel in groundwater.

Receptor Scenario Selection. The SI Summary states that Parcel 188(7) will be used for mixed business. Lacking more specific information, it is reasonable to select the groundskeeper as the most highly exposed long-term receptor for any kind of industrial or commercial land use. The groundskeeper is assumed to be exposed to surface soil. A construction worker is included as a plausible receptor for short-term exposure, because construction activity is likely to be required for development of Parcel 188(7) for any kind of useful application. Construction would probably include excavation; therefore, the construction worker is assumed to be exposed to total soil rather than only surface soil. An on-site resident is also included, although development for residential use is unlikely, to provide additional perspective. Also, sites that "pass" a residential risk evaluation generally can be released for unrestricted use with no further action. The resident is evaluated for exposure to surface soil, and a second time for exposure to total soil, assuming that construction (including excavation) is required to render the site fit for residential use.

Groundwater is evaluated as if it were developed as a source of potable water. It is assumed that all receptors mentioned above would be exposed to groundwater.

SSSLs for all three receptor scenarios were used to select COPCs for the media mentioned above.

Risk Characterization. Risk characterization combines the exposure assumptions and toxicity assessment (incorporated in the SSSLs) with the exposure-point concentration (EPC) to quantify the incremental lifetime cancer risk (ILCR) and noncancer hazard index (HI). ILCR and HI estimates are computed for each COPC in each medium, and are summed across media to yield a total ILCR and total HI for each receptor scenario. The PRA differs from an SRA in that ordinarily no attempt is made to estimate an EPC that reflects a conservative estimate of average concentration for use in risk assessment, at least not in the first iteration. The 95 percent upper confidence limit on the mean (UCL) is usually used for this purpose. Instead, the MDC is adopted as the EPC, at least for the first iteration, which imparts a conservative bias to the PRA.

EPA (1990) considers ILCR estimates below 1E-6 to be negligible, ILCR estimates from 1E-6 to 1E-4 to fall within a risk management range, and ILCR estimates above 1E-4 to be generally unacceptable. EPA (1989) considers HI values below the threshold level of 1 to indicate that the occurrence of adverse noncancer health effects is unlikely. Summing HI values across chemicals, however, is considered to impart a conservative bias to the assessment, because only those chemicals that share a mechanism of toxicity are likely to interact in an additive manner. Since data regarding mechanism of toxicity are generally insufficient, target organ or critical effect is used as a surrogate. In other words, chemicals that act upon the same target organ or that have the same critical effect are considered to act by the same mechanism of toxicity. Therefore, when HI values summed across chemicals and media exceed the threshold level of 1, the HI values may be re-summed by target organ to refine the assessment.

Risk values may be rounded to one significant figure to reflect the uncertainty about their estimation (EPA, 1989, 2002). For example, a calculated ILCR of 9.50E-7 would be rounded to 1E-6 and interpreted as falling within the risk management range. Similarly, a calculated ILCR of 1.49E-4 would be rounded to 1E-4 and interpreted as falling within, but not exceeding, the risk management range. Also, an HI of 1.49E+0 would be rounded to 1 and interpreted as not exceeding the threshold level of 1. Risk estimates in this document are presented in scientific notation with two places to the right of the decimal to facilitate checking calculations. Rounding is done only if needed to simplify interpretation.

The groundskeeper is potentially exposed to surface soil and groundwater at Parcel 188(7). COPCs selected for exposure to surface soil for the groundskeeper for the first iteration of the risk assessment include arsenic, based on cancer risk, and aluminum and iron, based on noncancer effects (Table 1). No chemicals were selected as COPCs for groundskeeper exposure to groundwater (Table 5). The total ILCR for the groundskeeper was 1.06E-5, which is within the risk management range. The total HI for the groundskeeper was 6.80E-1, which is below the threshold level of 1. It is concluded that exposure to surface soil and groundwater on Parcel 188(7) is unlikely to pose unacceptable cancer risk or risk of adverse noncancer health effects to a groundskeeper.

The construction worker is potentially exposed to total soil and groundwater at Parcel 188(7). COPCs selected for construction worker exposure to total soil for the first iteration of the risk assessment include arsenic, based on cancer risk, and aluminum, arsenic and iron, based on noncancer effects (Table 3). No chemicals were selected as COPCs for construction worker exposure to groundwater (Table 6). The total ILCR for exposure to total soil was 1.04E-6, which

is near the low end of the risk management range. The total HI for the construction worker was 1.96E+0, which exceeds the threshold level of 1.

The total HI exceeding the threshold level of 1 prompted a second iteration or refined assessment for the construction worker, based on segregating HI by target organ. Target organs or critical effect and HI values (in parentheses) for chemicals identified as COPCs in total soil (Table 3) include:

Aluminum: nervous system (1.43E+0)
Arsenic: skin and vascular system (1.35E-1)
Iron: iron overload (3.91E-1).

(Target organs or critical effects associated with each chemical are documented in the toxicity profiles appended to IT [2000.) As shown, the COPCs in total soil do not share a target organ; therefore, the HI values should not be summed. The HI values for arsenic and iron clearly fall below the threshold level of 1 and are considered not to represent a threat of adverse noncancer effects. The HI for aluminum, rounded to one significant figure, does not exceed the threshold level of 1. Furthermore, there is no plausible explanation for aluminum and iron to be present as site-related compounds, because these elements are not components of the CWAs that were used at the site. It is concluded that exposure to total soil and groundwater on Parcel 188(7) is unlikely to pose unacceptable cancer risk or risk of adverse noncancer health effects to a construction worker.

The on-site resident was included for the additional information and perspective provided by evaluation of the most highly exposed receptor, although residential development is not included in the plans for Parcel 188(7). Should the residential scenario "pass" the PRA, the site can be released for unrestricted use with no further action. The on-site resident was evaluated for exposure to surface soil and groundwater, and for exposure to total soil and groundwater. COPCs selected for exposure to surface soil for the first iteration of the risk assessment include arsenic and benzo(a)pyrene for cancer risk, and aluminum, arsenic, iron and vanadium for noncancer effects (Table 2). COPCs selected for exposure to groundwater for the first iteration include barium and nickel based on noncancer effects (Table 7). No groundwater chemicals were selected as COPCs for cancer risk. The total ILCR for the on-site resident exposed to surface soil and groundwater was 4.32E-5, which is within the risk management range. The total HI summed across surface soil and groundwater was 4.07E+0, which exceeds the threshold level of 1.

The total HI exceeding the threshold level of 1 prompted a second iteration or refined assessment for the on-site resident exposed to surface soil and groundwater. Target organs or critical effect and HI values (in parentheses) for chemicals identified as COPCs in surface soil and groundwater include:

Surface Soil (Table 2):
Aluminum: nervous system (4.15E-1)
Arsenic: skin and vascular system (7.21E-1)
Iron: iron overload (2.55E+0)

Vanadium: no target organ identified (1.38E-1)

Groundwater (Table 7):

Barium: elevated blood pressure and kidney (1.27E-1)

Nickel: reduced body and organ weight (1.19E-1)

(Target organs associated with each chemical are documented in the toxicity profiles appended to IT [2000.) As shown, the COPCs in surface soil and groundwater do not share a target organ; therefore, the HI values should not be summed. The HI values for aluminum, arsenic, vanadium, barium and nickel clearly fall below the threshold level of 1 and are considered not to represent a threat of adverse noncancer effects. The HI for iron exceeds the threshold level of 1. EPA (2002), however, considers the toxicity value for iron to be unsuitable for use in quantitative risk assessment because it is based on average dietary consumption rather than toxicological properties. In other words, it is likely that the SSSL for iron, and the toxicity value on which it is based, overstate the toxicity of iron. It is concluded that exposure to iron in surface soil does not represent a threat to human health.

The on-site resident was also evaluated for exposure to total soil and groundwater. COPCs selected for exposure to total soil for the first iteration of the risk assessment include arsenic and benzo(a)pyrene for cancer risk, and aluminum, antimony, arsenic, chromium, iron and vanadium for noncancer effects (Table 4). COPCs selected for exposure to groundwater for the first iteration include barium and nickel based on noncancer effects (Table 7), the same as noted for exposure to surface soil and groundwater. No groundwater chemicals were selected as COPCs for cancer risk. The total ILCR for the on-site resident exposed to total soil and groundwater was 5.21E-5, which is within the risk management range. The total HI summed across total soil and groundwater was 4.80E+0, which exceeds the threshold level of 1.

The total HI exceeding the threshold level of 1 prompted a second iteration or refined assessment for the on-site resident exposed to total soil and groundwater. Target organs or critical effect and HI values (in parentheses) for chemicals identified as COPCs in total soil and groundwater include:

Total Soil (Table 4):

Aluminum: nervous system (6.13E-1)

Antimony: heart (1.73E-1)

Arsenic: skin and vascular system (8.83E-1)

Chromium: GI tract, fetus/reproduction, bone marrow, liver (1.68E-1)

Iron: iron overload (2.55E+0)

Vanadium: no target organ identified (1.68E-1)

Groundwater (Table 7):

Barium: elevated blood pressure and kidney (1.27E-1)

Nickel: reduced body and organ weight (1.19E-1)

(Target organs associated with each chemical are documented in the toxicity profiles appended to IT [2000.) As shown, the COPCs in total soil and groundwater do not share a target organ; therefore, the HI values should not be summed. The HI values for aluminum, antimony, arsenic, chromium, vanadium, barium and nickel clearly fall below the threshold level of 1 and are

considered not to represent a threat of adverse noncancer effects. The HI for iron exceeds the threshold level of 1. However, as noted above, EPA (2002) considers the toxicity value for iron to be unsuitable for use in quantitative risk assessment. It is concluded that exposure to iron in surface soil does not represent a threat to human health.

In conclusion, the PRA suggests that soil is lightly contaminated with metals and PAHs, and the groundwater is lightly contaminated with metals. Metals, with the exception of arsenic, are not related to the CWAs associated with the site. Their identification as site-related COPCs in soil and groundwater may reflect the limitations of the metals background data set rather than an actual release. None of the metals in either medium resulted in an HI above the threshold level of 1 except for iron. The toxicity value for iron, however, is considered unsuitable for quantitative risk assessment, because it may overstate the toxicity of the metal. Therefore, it is concluded that exposure to soil and groundwater at Parcel 188(7) does not pose an unacceptable cancer risk or a threat of noncancer effects to any of the receptors evaluated herein. Parcel 188(7) can be released for unrestricted use requiring no further action.

References

IT Corporation (IT), 2000, ***Human Health and Ecological Screening Values and PAH Background Summary Report***, Final, Fort McClellan, Calhoun County, Alabama, Prepared for U.S. Army Corps of Engineers, Mobile District, August.

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U.S. Environmental Protection Agency (EPA), 1989, ***Risk Assessment Guidance for Superfund Volume I Human Health Evaluation Manual (Part A)***, Interim Final, Office of Emergency and Remedial Response, Washington, DC, EPA/540/1-89/002, December.

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U.S. Environmental Protection Agency (EPA), 2002, ***Region 4 Human Health Risk Assessment Bulletins – Supplement to RAGS, Interim Human Health Risk Assessment Bulletins***, Waste Management Division, EPA Region 4, Atlanta, GA, on line.

Table 1

Preliminary Risk Assessment for the Groundskeeper Exposure to Surface Soil
Old Toxic Training Area, Parcel 188(7)
Fort McClellan, Calhoun County, Alabama

Chemical	MDC	BSC	UTL	Site-Related Chemical?[a]	Groundskeeper Soil SSSL-c[b]	Groundskeeper Soil SSSL-n[c]	Groundskeeper Cancer COPC?[d]	Groundskeeper Noncancer COPC?[e]	Groundskeeper ILCR[f]	Groundskeeper HI[g]
Metals										
Aluminum	3.24E+04	1.63E+04	2.29E+04	3.24E+04	NA	6.69E+03		3.24E+04		4.85E-01
Arsenic	1.69E+01	1.37E+01	2.54E+01	1.69E+01	1.59E+00	3.06E+01	1.69E+01		1.06E-05	
Barium	1.63E+02	1.24E+02	1.94E+02	1.63E+02	NA	6.50E+02				
Beryllium	1.16E+00	8.00E-01	1.19E+00	1.16E+00	1.70E+01	2.39E+01				
Calcium	1.14E+04	1.72E+03	3.55E+03	1.14E+04	NA	NA				
Chromium[h]	3.22E+01	3.70E+01	6.44E+01		3.41E+00	9.96E+01				
Cobalt	6.88E+00	1.52E+01	3.25E+01		NA	2.90E+01				
Copper	6.67E+01	1.27E+01	2.25E+01	6.67E+01	NA	4.08E+03				
Iron	5.98E+04	3.42E+04	5.54E+04	5.98E+04	NA	3.06E+04		5.98E+04		1.95E-01
Lead	2.70E+01	4.01E+01	6.38E+01		NA	8.80E+02				
Magnesium	7.14E+03	1.03E+03	2.16E+03	7.14E+03	NA	NA				
Manganese	2.11E+02	1.58E+03	4.66E+03		NA	7.05E+01				
Mercury	6.40E-02	8.00E-02	1.25E-01		NA	2.85E+01				
Nickel	2.80E+01	1.03E+01	2.00E+01	2.80E+01	1.70E+02	2.02E+03				
Potassium	3.78E+03	8.00E+02	1.83E+03	3.78E+03	NA	NA				
Selenium	3.93E+00	4.80E-01	5.63E-01	3.93E+00	NA	5.11E+02				
Sodium	1.19E+02	6.34E+02	4.51E+02		NA	NA				
Vanadium	7.31E+01	5.88E+01	9.94E+01	7.31E+01	NA	6.97E+02				
Zinc	5.27E+01	4.06E+01	7.37E+01	5.27E+01	NA	3.06E+04				
SEMIVOLATILE ORGANIC COMPOUNDS										
2-Methylnaphthalene	1.50E+01			1.50E+01	NA	1.39E+03				
Acenaphthene	9.50E-02			9.50E-02	NA	6.07E+03				
Anthracene	1.10E-01			1.10E-01	NA	3.04E+04				
Benzo(a)anthracene	3.30E-01			3.30E-01	3.85E+00	NA				
Benzo(a)pyrene	3.00E-01			3.00E-01	3.85E-01	NA				
Benzo(b)fluoranthene	4.30E-01			4.30E-01	3.85E+00	NA				
Benzo(ghi)perylene	2.40E-01			2.40E-01	NA	3.03E+03				
Benzo(k)fluoranthene	1.40E-01			1.40E-01	3.85E+01	NA				
Carbazole	8.40E-02			8.40E-02	1.42E+02	NA				
Chrysene	3.00E-01			3.00E-01	3.86E+02	NA				
Dibenz(a,h)anthracene	6.00E-02			6.00E-02	3.86E-01	NA				
Fluoranthene	7.70E-01			7.70E-01	NA	4.05E+03				
Indeno(1,2,3-cd)pyrene	2.40E-01			2.40E-01	3.85E+00	NA				
Naphthalene	8.80E+00			8.80E+00	NA	1.39E+03				
Phenanthrene	4.80E-01			4.80E-01	NA	3.03E+04				
Pyrene	5.60E-01			5.60E-01	NA	3.05E+03				

Table 1

Preliminary Risk Assessment for the Groundskeeper Exposure to Surface Soil
Old Toxic Training Area, Parcel 188(7)
Fort McClellan, Calhoun County, Alabama

Chemical	MDC	BSC	UTL	Site-Related Chemical?[a]	Groundskeeper Soil SSSL-c[b]	Groundskeeper Soil SSSL-n[c]	Groundskeeper Cancer COPC?[d]	Groundskeeper Noncancer COPC?[e]	Groundskeeper ILCR[f]	Groundskeeper HI[g]
VOLATILE ORGANIC COMPOUNDS										
1,2,4-Trimethylbenzene	3.30E+02			3.30E+02	NA	3.20E+03				
1,2-Dimethylbenzene	8.00E+01			8.00E+01	NA	2.03E+05				
1,3,5-Trimethylbenzene	1.10E+02			1.10E+02	NA	3.20E+03				
2-Butanone	1.70E-02			1.70E-02	NA	5.86E+04				
4-Methyl-2-pentanone	5.40E-03			5.40E-03	NA	7.53E+03				
Acetone	6.10E-01			6.10E-01	NA	1.02E+04				
Cumene	1.20E+01			1.20E+01	NA	9.98E+03				
Ethylbenzene	4.00E+01			4.00E+01	NA	1.01E+04				
Naphthalene	5.50E+01			5.50E+01	NA	1.39E+03				
Toluene	2.60E+00			2.60E+00	NA	1.96E+04				
n-Butylbenzene	2.80E+01			2.80E+01	NA	1.02E+03				
n-Propylbenzene	5.30E+01			5.30E+01	NA	1.02E+03				
p-Cymene	4.50E+00			4.50E+00	NA	2.03E+04				
sec-Butylbenzene	8.20E+00			8.20E+00	NA	1.02E+03				
Total ILCR, HI									**1.06E-05**	**6.80E-01**

All concentrations expressed as mg/kg.
MDC = maximum detected concentration; BSC = background screening criterion; UTL = 95% Upper Tolerance Limit.
NA = Not Available
[a] MDC presented only if it exceeds BSC, or no BSC is available.
[b] Site-specific screening level (SSSL) based on cancer risk for the groundskeeper exposure to soil.
[c] Site-specific screening level based on noncancer hazard for the groundskeeper exposure to soil.
[d] MDC presented only if it exceeds SSSL-c.
[e] MDC presented only if it exceeds SSSL-n.
[f] Incremental lifetime cancer risk for the groundskeeper exposed to chemical in surface soil.
[g] Hazard index for noncancer effects for the groundskeeper exposed to chemical in surface soil.
[h] SSSL based on chromium VI.

Table 2

Preliminary Risk Assessment for the Resident Exposure to Surface Soil
Old Toxic Training Area, Parcel 188(7)
Fort McClellan, Calhoun County, Alabama

Chemical	MDC	BSC	UTL	Site-Related Chemical?[a]	Resident Soil SSSL-c[b]	Resident Soil SSSL-n[c]	Resident Cancer COPC?[d]	Resident Noncancer COPC?[e]	Resident ILCR[f]	Resident HI[g]
Metals										
Aluminum	3.24E+04	1.63E+04	2.29E+04	3.24E+04	NA	7.80E+03		3.24E+04		4.15E-01
Arsenic	1.69E+01	1.37E+01	2.54E+01	1.69E+01	4.26E-01	2.34E+00	1.69E+01	1.69E+01	3.97E-05	7.21E-01
Barium	1.63E+02	1.24E+02	1.94E+02	1.63E+02	NA	5.47E+02				
Beryllium	1.16E+00	8.00E-01	1.19E+00	1.16E+00	NA	9.60E+00				
Calcium	1.14E+04	1.72E+03	3.55E+03	1.14E+04	NA	NA				
Chromium[h]	3.22E+01	3.70E+01	6.44E+01		NA	2.32E+01				
Cobalt	6.88E+00	1.52E+01	3.25E+01		NA	4.68E+02				
Copper	6.67E+01	1.27E+01	2.25E+01	6.67E+01	NA	3.13E+02				
Iron	5.98E+04	3.42E+04	5.54E+04	5.98E+04	NA	2.34E+03		5.98E+04		2.55E+00
Lead	2.70E+01	4.01E+01	6.38E+01		NA	4.00E+02				
Magnesium	7.14E+03	1.03E+03	2.16E+03	7.14E+03	NA	NA				
Manganese	2.11E+02	1.58E+03	4.66E+03		NA	3.63E+02				
Mercury	6.40E-02	8.00E-02	1.25E-01		NA	2.33E+00				
Nickel	2.80E+01	1.03E+01	2.00E+01	2.80E+01	NA	1.54E+02				
Potassium	3.78E+03	8.00E+02	1.83E+03	3.78E+03	NA	NA				
Selenium	3.93E+00	4.80E-01	5.63E-01	3.93E+00	NA	3.91E+01				
Sodium	1.19E+02	6.34E+02	4.51E+02		NA	NA				
Vanadium	7.31E+01	5.88E+01	9.94E+01	7.31E+01	NA	5.31E+01		7.31E+01		1.38E-01
Zinc	5.27E+01	4.06E+01	7.37E+01	5.27E+01	NA	2.34E+03				
SEMIVOLATILE ORGANIC COMPOUNDS										
2-Methylnaphthalene	1.50E+01			1.50E+01	NA	1.55E+02				
Acenaphthene	9.50E-02			9.50E-02	NA	4.63E+02				
Anthracene	1.10E-01			1.10E-01	NA	2.33E+03				
Benzo(a)anthracene	3.30E-01			3.30E-01	8.51E-01	NA				
Benzo(a)pyrene	3.00E-01			3.00E-01	8.51E-02	NA	3.00E-01		3.53E-06	
Benzo(b)fluoranthene	4.30E-01			4.30E-01	8.51E-01	NA				
Benzo(ghi)perylene	2.40E-01			2.40E-01	NA	2.32E+02				
Benzo(k)fluoranthene	1.40E-01			1.40E-01	8.51E+00	NA				
Carbazole	8.40E-02			8.40E-02	3.11E+01	NA				
Chrysene	3.00E-01			3.00E-01	8.61E+01	NA				
Dibenz(a,h)anthracene	6.00E-02			6.00E-02	8.61E-02	NA				
Fluoranthene	7.70E-01			7.70E-01	NA	3.09E+02				
Indeno(1,2,3-cd)pyrene	2.40E-01			2.40E-01	8.51E-01	NA				
Naphthalene	8.80E+00			8.80E+00	NA	1.55E+02				
Phenanthrene	4.80E-01			4.80E-01	NA	2.32E+03				
Pyrene	5.60E-01			5.60E-01	NA	2.33E+02				

Table 2

Preliminary Risk Assessment for the Resident Exposure to Surface Soil
Old Toxic Training Area, Parcel 188(7)
Fort McClellan, Calhoun County, Alabama

Chemical	MDC	BSC	UTL	Site-Related Chemical?[a]	Resident Soil SSSL-c[b]	Resident Soil SSSL-n[c]	Resident Cancer COPC?[d]	Resident Noncancer COPC?[e]	Resident ILCR[f]	Resident HI[g]
VOLATILE ORGANIC COMPOUNDS										
1,2,4-Trimethylbenzene	3.30E+02			3.30E+02	NA	3.88E+02				
1,2-Dimethylbenzene	8.00E+01			8.00E+01	NA	1.55E+04				
1,3,5-Trimethylbenzene	1.10E+02			1.10E+02	NA	3.88E+02				
2-Butanone	1.70E-02			1.70E-02	NA	4.66E+03				
4-Methyl-2-pentanone	5.40E-03			5.40E-03	NA	6.21E+02				
Acetone	6.10E-01			6.10E-01	NA	7.76E+02				
Cumene	1.20E+01			1.20E+01	NA	7.77E+02				
Ethylbenzene	4.00E+01			4.00E+01	NA	7.77E+02				
Naphthalene	5.50E+01			5.50E+01	NA	1.55E+02				
Toluene	2.60E+00			2.60E+00	NA	1.55E+03				
n-Butylbenzene	2.80E+01			2.80E+01	NA	7.77E+01				
n-Propylbenzene	5.30E+01			5.30E+01	NA	7.77E+01				
p-Cymene	4.50E+00			4.50E+00	NA	1.55E+03				
sec-Butylbenzene	8.20E+00			8.20E+00	NA	7.77E+01				
Total ILCR, HI									**4.32E-05**	**3.82E+00**

All concentrations expressed as mg/kg.
MDC = maximum detected concentration; BSC = background screening criterion; UTL = 95% Upper Tolerance Limit.
NA = Not Available

[a] MDC presented only if it exceeds BSC, or no BSC is available.

[b] Site-specific screening level (SSSL) based on cancer risk for the resident exposure to soil.

[c] Site-specific screening level based on noncancer hazard for the resident exposure to soil.

[d] MDC presented only if it exceeds SSSL-c.

[e] MDC presented only if it exceeds SSSL-n.

[f] Incremental lifetime cancer risk for the resident exposed to chemical in surface soil.

[g] Hazard index for noncancer effects for the resident exposed to chemical in surface soil.

[h] SSSL based on chromium VI.

Table 3

Preliminary Risk Assessment for the Construction Worker Exposure to Total Soil
Old Toxic Training Area, Parcel 188(7)
Fort McClellan, Calhoun County, Alabama

Chemical	MDC	BSC	UTL	Site-Related Chemical?[a]	Construction Worker Soil SSSL-c[b]	Construction Worker Soil SSSL-n[c]	Construction Worker Cancer COPC?[d]	Construction Worker Noncancer COPC?[e]	Construction Worker ILCR[f]	Construction Worker HI[g]
Metals										
Aluminum	4.78E+04	1.50E+04	1.80E+04	4.78E+04	NA	3.34E+03		4.78E+04		1.43E+00
Antimony	5.38E+00	1.66E+00	7.14E+00	5.38E+00	NA	1.99E+01				
Arsenic	2.07E+01	1.60E+01	3.24E+01	2.07E+01	1.98E+01	1.53E+01	2.07E+01	2.07E+01	1.04E-06	1.35E-01
Barium	1.63E+02	1.76E+02	2.42E+02		NA	3.25E+02				
Beryllium	1.53E+00	8.31E-01	1.50E+00	1.53E+00	2.13E+02	9.60E+00				
Calcium	1.14E+04	1.20E+03	2.27E+03	1.14E+04	NA	NA				
Chromium[h]	3.89E+01	3.76E+01	5.63E+01	3.89E+01	4.26E+01	4.91E+01				
Cobalt	1.35E+01	1.63E+01	3.63E+01		NA	1.45E+01				
Copper	9.07E+01	1.59E+01	2.59E+01	9.07E+01	NA	2.04E+03				
Iron	5.98E+04	3.92E+04	5.63E+04	5.98E+04	NA	1.53E+04		5.98E+04		3.91E-01
Lead	3.85E+01	3.93E+01	6.05E+01		NA	8.80E+02				
Magnesium	7.14E+03	9.06E+02	2.16E+03	7.14E+03	NA	NA				
Manganese	4.00E+02	1.47E+03	4.12E+03		NA	3.52E+01				
Mercury	6.40E-02	7.04E-02	9.40E-02		NA	1.38E+01				
Nickel	5.90E+01	1.16E+01	1.69E+01	5.90E+01	2.13E+03	9.59E+02				
Potassium	3.78E+03	7.57E+02	8.31E+02	3.78E+03	NA	NA				
Selenium	4.93E+00	4.80E-01	5.71E-01	4.93E+00	NA	2.55E+02				
Sodium	1.69E+02	6.67E+02	5.60E+02		NA	NA				
Vanadium	8.93E+01	6.17E+01	9.05E+01	8.93E+01	NA	3.16E+02				
Zinc	9.41E+01	3.79E+01	7.13E+01	9.41E+01	NA	1.52E+04				
SEMIVOLATILE ORGANIC COMPOUNDS										
2-Methylnaphthalene	1.50E+01			1.50E+01	NA	6.82E+02				
Acenaphthene	9.50E-02			9.50E-02	NA	2.91E+03				
Anthracene	1.10E-01			1.10E-01	NA	1.48E+04				
Benzo(a)anthracene	3.30E-01			3.30E-01	4.62E+01	NA				
Benzo(a)pyrene	3.00E-01			3.00E-01	4.62E+00	NA				
Benzo(b)fluoranthene	4.30E-01			4.30E-01	4.62E+01	NA				
Benzo(ghi)perylene	2.40E-01			2.40E-01	NA	1.46E+03				
Benzo(k)fluoranthene	1.40E-01			1.40E-01	4.62E+02	NA				
Carbazole	8.40E-02			8.40E-02	1.70E+03	NA				
Chrysene	3.00E-01			3.00E-01	4.71E+03	NA				
Dibenz(a,h)anthracene	6.00E-02			6.00E-02	4.71E+00	NA				
Fluoranthene	7.70E-01			7.70E-01	NA	1.94E+03				
Indeno(1,2,3-cd)pyrene	2.40E-01			2.40E-01	4.62E+01	NA				
Naphthalene	8.80E+00			8.80E+00	NA	6.85E+02				
Phenanthrene	4.80E-01			4.80E-01	NA	1.46E+04				
Pyrene	5.60E-01			5.60E-01	NA	1.48E+03				

Table 3

Preliminary Risk Assessment for the Construction Worker Exposure to Total Soil
Old Toxic Training Area, Parcel 188(7)
Fort McClellan, Calhoun County, Alabama

Chemical	MDC	BSC	UTL	Site-Related Chemical?[a]	Construction Worker Soil SSSL-c[b]	Construction Worker Soil SSSL-n[c]	Construction Worker Cancer COPC?[d]	Construction Worker Noncancer COPC?[e]	Construction Worker ILCR[f]	Construction Worker HI[g]
VOLATILE ORGANIC COMPOUNDS										
1,2,4-Trimethylbenzene	3.30E+02			3.30E+02	NA	1.58E+03				
1,2-Dimethylbenzene	8.00E+01			8.00E+01	NA	9.96E+04				
1,3,5-Trimethylbenzene	1.10E+02			1.10E+02	NA	1.58E+03				
2-Butanone	1.70E-02			1.70E-02	NA	2.86E+04				
4-Methyl-2-pentanone	5.40E-03			5.40E-03	NA	3.69E+03				
Acetone	6.10E-01			6.10E-01	NA	4.95E+03				
Cumene	1.20E+01			1.20E+01	NA	4.05E+03				
Ethylbenzene	4.00E+01			4.00E+01	NA	4.94E+03				
Naphthalene	5.50E+01			5.50E+01	NA	6.85E+02				
Toluene	2.60E+00			2.60E+00	NA	9.62E+03				
n-Butylbenzene	2.80E+01			2.80E+01	NA	4.97E+02				
n-Propylbenzene	5.30E+01			5.30E+01	NA	4.97E+02				
p-Cymene	4.50E+00			4.50E+00	NA	9.93E+03				
sec-Butylbenzene	8.20E+00			8.20E+00	NA	4.97E+02				
Total ILCR, HI									**1.04E-06**	**1.96E+00**

All concentrations expressed as mg/kg.
MDC = maximum detected concentration; BSC = background screening criterion; UTL = 95% Upper Tolerance Limit.
-- = No ILCR or HI calculated
NA = Not Available
[a] MDC presented only if it exceeds BSC, or no BSC is available.
[b] Site-specific screening level (SSSL) based on cancer risk for the construction worker exposure to soil.
[c] Site-specific screening level based on noncancer hazard for the construction worker exposure to soil.
[d] MDC presented only if it exceeds SSSL-c.
[e] MDC presented only if it exceeds SSSL-n.
[f] Incremental lifetime cancer risk for the construction worker exposed to chemical in total soil.
[g] Hazard index for noncancer effects for the construction worker exposed to chemical in total soil.
[h] SSSL based on chromium VI.

Table 4

Preliminary Risk Assessment for the Resident Exposure to Total Soil
Old Toxic Training Area, Parcel 188(7)
Fort McClellan, Calhoun County, Alabama

Chemical	MDC	BSC	UTL	Site-Related Chemical?[a]	Resident Soil SSSL-c[b]	Resident Soil SSSL-n[c]	Resident Cancer COPC?[d]	Resident Noncancer COPC?[e]	Resident ILCR[f]	Resident HI[g]
METALS										
Aluminum	4.78E+04	1.50E+04	1.80E+04	4.78E+04	NA	7.80E+03		4.78E+04		6.13E-01
Antimony	5.38E+00	1.66E+00	7.14E+00	5.38E+00	NA	3.11E+00		5.38E+00		1.73E-01
Arsenic	2.07E+01	1.60E+01	3.24E+01	2.07E+01	4.26E-01	2.34E+00	2.07E+01	2.07E+01	4.86E-05	8.83E-01
Barium	1.63E+02	1.76E+02	2.42E+02		NA	5.47E+02				
Beryllium	1.53E+00	8.31E-01	1.50E+00	1.53E+00	NA	9.60E+00				
Calcium	1.14E+04	1.20E+03	2.27E+03	1.14E+04	NA	NA				
Chromium[h]	3.89E+01	3.76E+01	5.63E+01	3.89E+01	NA	2.32E+01		3.89E+01		1.68E-01
Cobalt	1.35E+01	1.63E+01	3.63E+01		NA	4.68E+02				
Copper	9.07E+01	1.59E+01	2.59E+01	9.07E+01	NA	3.13E+02				
Iron	5.98E+04	3.92E+04	5.63E+04	5.98E+04	NA	2.34E+03		5.98E+04		2.55E+00
Lead	3.85E+01	3.93E+01	6.05E+01		NA	4.00E+02				
Magnesium	7.14E+03	9.06E+02	2.16E+03	7.14E+03	NA	NA				
Manganese	4.00E+02	1.47E+03	4.12E+03		NA	3.63E+02				
Mercury	6.40E-02	7.04E-02	9.40E-02		NA	2.33E+00				
Nickel	5.90E+01	1.16E+01	1.69E+01	5.90E+01	NA	1.54E+02				
Potassium	3.78E+03	7.57E+02	8.31E+02	3.78E+03	NA	NA				
Selenium	4.93E+00	4.80E-01	5.71E-01	4.93E+00	NA	3.91E+01				
Sodium	1.69E+02	6.67E+02	5.60E+02		NA	NA				
Vanadium	8.93E+01	6.17E+01	9.05E+01	8.93E+01	NA	5.31E+01		8.93E+01		1.68E-01
Zinc	9.41E+01	3.79E+01	7.13E+01	9.41E+01	NA	2.34E+03				
SEMIVOLATILE ORGANIC COMPOUNDS										
2-Methylnaphthalene	1.50E+01			1.50E+01	NA	1.55E+02				
Acenaphthene	9.50E-02			9.50E-02	NA	4.63E+02				
Anthracene	1.10E-01			1.10E-01	NA	2.33E+03				
Benzo(a)anthracene	3.30E-01			3.30E-01	8.51E-01	NA				
Benzo(a)pyrene	3.00E-01			3.00E-01	8.51E-02	NA	3.00E-01		3.53E-06	
Benzo(b)fluoranthene	4.30E-01			4.30E-01	8.51E-01	NA				
Benzo(ghi)perylene	2.40E-01			2.40E-01	NA	2.32E+02				
Benzo(k)fluoranthene	1.40E-01			1.40E-01	8.51E+00	NA				
Carbazole	8.40E-02			8.40E-02	3.11E+01	NA				
Chrysene	3.00E-01			3.00E-01	8.61E+01	NA				
Dibenz(a,h)anthracene	6.00E-02			6.00E-02	8.61E-02	NA				
Fluoranthene	7.70E-01			7.70E-01	NA	3.09E+02				
Indeno(1,2,3-cd)pyrene	2.40E-01			2.40E-01	8.51E-01	NA				
Naphthalene	8.80E+00			8.80E+00	NA	1.55E+02				
Phenanthrene	4.80E-01			4.80E-01	NA	2.32E+03				
Pyrene	5.60E-01			5.60E-01	NA	2.33E+02				

Table 4

Preliminary Risk Assessment for the Resident Exposure to Total Soil
Old Toxic Training Area, Parcel 188(7)
Fort McClellan, Calhoun County, Alabama

Chemical	MDC	BSC	UTL	Site-Related Chemical?[a]	Resident Soil SSSL-c[b]	Resident Soil SSSL-n[c]	Resident Cancer COPC?[d]	Resident Noncancer COPC?[e]	Resident ILCR[f]	Resident HI[g]
VOLATILE ORGANIC COMPOUNDS										
1,2,4-Trimethylbenzene	3.30E+02			3.30E+02	NA	3.88E+02				
1,2-Dimethylbenzene	8.00E+01			8.00E+01	NA	1.55E+04				
1,3,5-Trimethylbenzene	1.10E+02			1.10E+02	NA	3.88E+02				
2-Butanone	1.70E-02			1.70E-02	NA	4.66E+03				
4-Methyl-2-pentanone	5.40E-03			5.40E-03	NA	6.21E+02				
Acetone	6.10E-01			6.10E-01	NA	7.76E+02				
Cumene	1.20E+01			1.20E+01	NA	7.77E+02				
Ethylbenzene	4.00E+01			4.00E+01	NA	7.77E+02				
Naphthalene	5.50E+01			5.50E+01	NA	1.55E+02				
Toluene	2.60E+00			2.60E+00	NA	1.55E+03				
n-Butylbenzene	2.80E+01			2.80E+01	NA	7.77E+01				
n-Propylbenzene	5.30E+01			5.30E+01	NA	7.77E+01				
p-Cymene	4.50E+00			4.50E+00	NA	1.55E+03				
sec-Butylbenzene	8.20E+00			8.20E+00	NA	7.77E+01				
Total ILCR, HI									**5.21E-05**	**4.55E+00**

All concentrations expressed as mg/kg.
MDC = maximum detected concentration; BSC = background screening criterion; UTL = 95% Upper Tolerance Limit.
NA = Not Available
[a] MDC presented only if it exceeds BSC, or no BSC is available.
[b] Site-specific screening level (SSSL) based on cancer risk for the resident exposure to soil.
[c] Site-specific screening level based on noncancer hazard for the resident exposure to soil.
[d] MDC presented only if it exceeds SSSL-c.
[e] MDC presented only if it exceeds SSSL-n.
[f] Incremental lifetime cancer risk for the resident exposed to chemical in total soil.
[g] Hazard index for noncancer effects for the resident exposed to chemical in total soil.
[h] SSSL based on chromium VI.

Table 5

Preliminary Risk Assessment for the Groundskeeper Exposure to Groundwater
Old Toxic Training Area, Parcel 188(7)
Fort McClellan, Calhoun County, Alabama

Chemical	MDC	BSC	UTL	Site-Related Chemical?[a]	Groundskeeper Groundwater SSSL-c[b]	Groundskeeper Groundwater SSSL-n[c]	Groundskeeper Cancer COPC?[d]	Groundskeeper Noncancer COPC?[e]	Groundskeeper ILCR[f]	Groundskeeper HI[g]
METALS										
Aluminum	7.89E-02	2.34E+00	5.95E+00		NA	1.01E+01				
Barium	1.39E-01	1.27E-01	4.72E-01	1.39E-01	NA	7.12E-01				
Calcium	5.97E+01	5.65E+01	7.14E+01	5.97E+01	NA	NA				
Cobalt	1.64E-02	2.34E-02	2.02E-02		NA	6.08E-01				
Iron	1.09E+00	7.04E+00	2.20E+01		NA	3.05E+00				
Magnesium	1.67E+01	2.13E+01	2.20E+01		NA	NA				
Manganese	2.26E-01	5.81E-01	4.13E+00		NA	4.44E-01				
Nickel	3.71E-02	NA	3.43E-02	3.71E-02	NA	2.02E-01				
Potassium	2.21E+00	7.20E+00	1.60E+01		NA	NA				
Selenium	3.22E-03	NA	9.71E-02	3.22E-03	NA	5.08E-02				
Sodium	8.95E+00	1.48E+01	4.90E+01		NA	NA				
Zinc	6.35E-02	2.20E-01	1.16E+00		NA	3.04E+00				
VOLATILE ORGANIC COMPOUNDS										
Carbon disulfide	1.80E-03			1.80E-03	NA	9.21E-01				
Carbon tetrachloride	3.20E-04			3.20E-04	1.98E-03	6.43E-03				
Total ILCR, HI									--	--

All concentrations expressed as mg/L.
MDC = maximum detected concentration; BSC = background screening criterion; UTL = 95% Upper Tolerance Limit.
-- = No ILCR or HI calculated
NA = Not Available
[a] MDC presented only if it exceeds BSC, or no BSC is available.
[b] Site-specific screening level (SSSL) based on cancer risk for the groundskeeper exposure to groundwater.
[c] Site-specific screening level based on noncancer hazard for the groundskeeper exposure to groundwater.
[d] MDC presented only if it exceeds SSSL-c.
[e] MDC presented only if it exceeds SSSL-n.
[f] Incremental lifetime cancer risk for the groundskeeper exposed to chemical in groundwater.
[g] Hazard index for noncancer effects for the groundskeeper exposed to chemical in groundwater.

Table 6

Preliminary Risk Assessment for the Construction Worker Exposure to Groundwater
Old Toxic Training Area, Parcel 188(7)
Fort McClellan, Calhoun County, Alabama

Chemical	MDC	BSC	UTL	Site-Related Chemical?[a]	Construction Worker GW SSSL-c[b]	Construction Worker GW SSSL-n[c]	Construction Worker COPC?[d]	Construction Worker COPC?[e]	Construction Worker ILCR[f]	Construction Worker HI[g]
METALS										
Aluminum	7.89E-02	2.34E+00	5.95E+00		NA	1.01E+01				
Barium	1.39E-01	1.27E-01	4.72E-01	1.39E-01	NA	7.12E-01				
Calcium	5.97E+01	5.65E+01	7.14E+01	5.97E+01	NA	NA				
Cobalt	1.64E-02	2.34E-02	2.02E-02		NA	6.08E-01				
Iron	1.09E+00	7.04E+00	2.20E+01		NA	3.05E+00				
Magnesium	1.67E+01	2.13E+01	2.20E+01		NA	NA				
Manganese	2.26E-01	5.81E-01	4.13E+00		NA	4.44E-01				
Nickel	3.71E-02	NA	3.43E-02	3.71E-02	NA	2.02E-01				
Potassium	2.21E+00	7.20E+00	1.60E+01		NA	NA				
Selenium	3.22E-03	NA	9.71E-02	3.22E-03	NA	5.08E-02				
Sodium	8.95E+00	1.48E+01	4.90E+01		NA	NA				
Zinc	6.35E-02	2.20E-01	1.16E+00		NA	3.04E+00				
VOLATILE ORGANIC COMPOUNDS										
Carbon disulfide	1.80E-03			1.80E-03	NA	9.21E-01				
Carbon tetrachloride	3.20E-04			3.20E-04	4.95E-02	6.43E-03				
Total ILCR, HI									--	--

All concentrations expressed as mg/L.
MDC = maximum detected concentration; BSC = background screening criterion; UTL = 95% Upper Tolerance Limit.
-- = No ILCR or HI calculated
NA = Not Available
[a] MDC presented only if it exceeds BSC, or no BSC is available.
[b] Site-specific screening level (SSSL) based on cancer risk for the construction worker exposure to groundwater.
[c] Site-specific screening level based on noncancer hazard for the construction worker exposure to groundwater.
[d] MDC presented only if it exceeds SSSL-c.
[e] MDC presented only if it exceeds SSSL-n.
[f] Incremental lifetime cancer risk for the construction worker exposed to chemical in groundwater.
[g] Hazard index for noncancer effects for the construction worker exposed to chemical in groundwater.

Table 7

Preliminary Risk Assessment for the Resident Exposure to Groundwater
Old Toxic Training Area, Parcel 188(7)
Fort McClellan, Calhoun County, Alabama

Chemical	MDC	BSC	UTL	Site-Related Chemical?[a]	Resident Groundwater SSSL-c[b]	Resident Groundwater SSSL-n[c]	Resident COPC?[d]	Resident COPC?[e]	Resident ILCR[f]	Resident HI[g]
METALS										
Aluminum	7.89E-02	2.34E+00	5.95E+00		NA	1.56E+00				
Barium	1.39E-01	1.27E-01	4.72E-01	1.39E-01	NA	1.10E-01		1.39E-01		1.27E-01
Calcium	5.97E+01	5.65E+01	7.14E+01	5.97E+01	NA	NA				
Cobalt	1.64E-02	2.34E-02	2.02E-02		NA	9.39E-02				
Iron	1.09E+00	7.04E+00	2.20E+01		NA	4.69E-01				
Magnesium	1.67E+01	2.13E+01	2.20E+01		NA	NA				
Manganese	2.26E-01	5.81E-01	4.13E+00		NA	7.35E-02				
Nickel	3.71E-02	NA	3.43E-02	3.71E-02	NA	3.13E-02		3.71E-02		1.19E-01
Potassium	2.21E+00	7.20E+00	1.60E+01		NA	NA				
Selenium	3.22E-03	NA	9.71E-02	3.22E-03	NA	7.82E-03				
Sodium	8.95E+00	1.48E+01	4.90E+01		NA	NA				
Zinc	6.35E-02	2.20E-01	1.16E+00		NA	4.69E-01				
VOLATILE ORGANIC COMPOUNDS										
Carbon disulfide	1.80E-03			1.80E-03	NA	1.51E-01				
Carbon tetrachloride	3.20E-04			3.20E-04	4.08E-04	1.05E-03				
Total ILCR, HI									--	**2.46E-01**

All concentrations expressed as mg/L.
MDC = maximum detected concentration; BSC = background screening criterion; UTL = 95% Upper Tolerance Limit.
-- = No ILCR or HI calculated
NA = Not Available
[a] MDC presented only if it exceeds BSC, or no BSC is available.
[b] Site-specific screening level (SSSL) based on cancer risk for the resident exposure to groundwater.
[c] Site-specific screening level based on noncancer hazard for the resident exposure to groundwater.
[d] MDC presented only if it exceeds SSSL-c.
[e] MDC presented only if it exceeds SSSL-n.
[f] Incremental lifetime cancer risk for the resident exposed to chemical in groundwater.
[g] Hazard index for noncancer effects for the resident exposed to chemical in groundwater.